

brighter than 7.5 m., the number being 14,199. The magnitudes were obtained by Müller and Kempf, with a Zöllner Photometer, during the years 1886 to 1905, and are very carefully determined. Comparing with the work of H.C.O., however, it is at once seen that there are considerable differences in brightness; hence, for the present, the second decimal of a star's magnitude may be regarded as more or less a figment, and it will be so until a more accurate standard of stellar light-measurement is obtained. Yet, with the three volumes just referred to, astronomers possess a most valuable record of the brightness of many thousands of stars, which will doubtless be of the greatest use for reference, comparison, etc. in various stellar researches.

E. E. M.

Stellar Distribution and Drift.

Professor Lewis Boss (*Astronomical Journal*, No. 604), from the results of his determinations of proper motions of fundamental stars, has arrived at an interesting conclusion with regard to a number of stars in Taurus. He finds that thirty-nine stars, mostly brighter than the sixth magnitude, have proper motions accurately directed to a single point of the celestial sphere. The mean deviation in position angle of the proper motions is $\pm 1^\circ.8$. It appears that these stars form a globular cluster about 15° in diameter, having a central condensation; we may expect that many fainter stars will be found to belong to the cluster as soon as their motions have been determined with sufficient accuracy. The great angular dimensions of the cluster are due to its comparative nearness to the Earth at present; for example, it is estimated that in about sixty million years this Taurus-stream will appear as an ordinary globular cluster about 20' in diameter, constituted of stars of magnitudes 9-12. If this system is to be taken as typical of globular clusters in general, it would indicate that their linear dimensions may be much greater than is often supposed, for in this case it is clear that the distances of the component stars from each other cannot be much less than ordinary stellar distances.

A further advance in the investigation of the systematic motions of the stars has been made by Professor Dyson (*Proc. Roy. Soc. Edin.*, vol. xxviii. part. iii.). His results were obtained from the discussion of stars having large proper motions, distributed in all parts of the sky. The two favoured directions of motion were shown in a very striking manner, and were found to prevail in every region (including the part of the sky below 30° S. declination which had not previously been examined). In general, the investigation confirms and extends previous work on this subject; the principal divergence is in the position of the apex of the slower moving stream II.; there is also an indication that the velocity of this stream is rather greater than the value found from the Groombridge stars.

Professor Schwarzschild has made a great practical advance in the development of his theory (referred to in the last report), by

providing a very simple and convenient method of discussing the systematic motions of small groups of stars (*Göttingen Nachrichten*, February 1908). This method has been applied by Beljawski (*Ast. Nach.*, No. 4291) to the determination of the vertex and apex from Porter's proper motions. This position of the vertex (*i.e.* the direction of the major axis of the velocity-ellipsoid) is $A = 266^\circ$ $D = +24^\circ$, and thus differs seriously from the position found by Schwarzschild from the Groombridge stars, $A = 273^\circ$ $D = -6^\circ$; but it must be remembered that Porter's stars are those having large proper motions only, and the method used is strictly only applicable to unselected proper motions. Eddington (*Monthly Notices*, lxviii. p. 588) has given a method of applying the two-drift theory to the discussion of small groups of stars, and has examined by it the proper motions of the stars of the Zodiacal Catalogue.

A list of the determinations up to the present of the positions of the apices of the two streams and of the *vertex* (or direction of motion of one stream relative to the other) is given below. It may be noted that every one of the six determinations was made by a different analytical method.

	Apex. Stream I.		Apex. Stream II.		Vertex.	
	R.A.	Dec.	R.A.	Dec.	R.A.	Dec.
Kapteyn, Bradley stars . . .	85°	-11°	260°	-48°	91	+13
Eddington, Groombridge stars .	90	-19	292	-58	95	+3
Dyson, miscellaneous stars of large proper motion . . .	94	-7	240	-74		
Schwarzschild, Groombridge stars . . .	...	...	...	...	93	+6
Eddington, Zodiacal stars . . .	103	-11	330	-64	109	+6
Beljawski, Porter stars . . .	...	...	...	...	86	+24

In Groningen Publications, No. 19, Professor Kapteyn and Dr. de Sitter give the results of their determinations of the proper motions of 3300 stars from photographic plates prepared by Professor Donner. These plates received their first series of exposures in the years 1897-98, and, after remaining undeveloped for seven or in some cases eight years, were exposed again in 1904-06; the proper motions could then be derived by measuring the small distances between the different sets of images. The probable error of an annual proper motion was found to be not greater than $\pm 0.13''$ —a very satisfactory result considering the shortness of interval. It should be remembered that the object of the determination is not to find the motions of individual stars, but to provide material to be used in statistical discussions of the motions and distribution of the faint stars. For this purpose, also, the publication of a nearly equal number of parallaxes, mainly of the same stars, determined by the same method, is promised by the authors.

It may be noted that in the above investigation only three stars out of the 3300 were found to have annual proper motions exceeding $0.5''$. Professor Turner (*Monthly Notices*, lxix. p. 57), from a

comparison of measures of duplicated plates taken for the Oxford Astrographic Catalogue, finds only 6 stars out of 2822 with annual proper motions greater than $0''.2$. Both these results indicate a rather unexpected paucity of large proper motions among the faint stars.

A. S. E.

Star Catalogue.

Küstner's Catalogue of 10,663 Stars between 0° and 51° North Declination for 1900.

The great bulk of the observations for this catalogue were made in the years 1894–1899; revision observations were, however, obtained when needed until 1903. The whole of the observations were made by Professor Küstner himself, and the instrument—the 6-inch Repsold Meridian Circle of the Bonn Observatory—remained unaltered during the comparatively short time over which the observations extended. Seeing that the observations numbered something like 30,000, the task has been a prodigious one for a single individual to have accomplished in so limited a time; it must clearly have required an extraordinary degree of energy and devotion on the part of Professor Küstner. Rather more than 7000 of the stars are contained in catalogues of the Astronomische Gesellschaft, and the hope is expressed that the present work may enable these catalogues to be compared more closely than has hitherto been possible with a uniform fundamental system.

Professor Küstner has investigated the effect of magnitude-equation both in right ascension and declination with great completeness. The effect is in part directly eliminated, since screens were used in observing the fundamental and other bright stars, in order to reduce them in the mean to magnitude 8.5; but in addition the magnitude equation both of the observer and of the fundamental catalogue (that of Auwers) was determined. Professor Küstner's magnitude-equation in right ascension proved to be very small; in declination it was considerably larger. The magnitudes of the stars were estimated at each observation, and, after all necessary corrections had been applied, reduced to the Potsdam scale. The resulting magnitudes are given in the catalogue.

In the case of double stars occurring in the catalogue, measures of the positions and magnitudes of the components were made with an equatorial, thus supplementing the meridian observations.

A. S. E.

The Astrographic Chart and Catalogue.

The annual report of this undertaking has now become little more than a statement of the publications issued during the year. At the beginning of 1908, volume ii. of the Greenwich Section was distributed, which completes the publication of the rectangular co-ordinates of the stars in the region from 64° N. to the Pole allotted